PUBLICATION 1575

NORTHERN GARDENING

Agriculture Canada

PUBLICATION 1575, available from
Information Services, Agriculture Canada, Ottawa K1A 0C7

Cat. No. A53–1575/1976 ISBN: 0-662-00877-4
Reprinted 1980, 1981 10M–5:81

CONTENTS

A GARDEN IN THE NORTH

By growing your own vegetables, fruits, and ornamentals you can reduce your food costs and greatly improve the quality of your food and your standard of living.

Some vegetables and flowers can be grown by planting seed directly in the garden, but others must be seeded indoors or in a hotbed or greenhouse and then transplanted to the garden. You can grow a wider variety of crops and increase their yield by:

- raising soil temperatures with the use of plastic mulches, or ridging, or both,
- increasing air temperature by covering the rows with plastic tents or shelters, and
- using sprinkler irrigation to reduce frost damage in late summer and fall.

The practices of good gardening and the directions for performing several special methods are described in this publication. For more information write to the Information Division, Agriculture Canada, Ottawa, Ont. KIA 0C7, for a copy of Publication 1408, *Gardening on permafrost.*

NORTHERN GARDENING[1]

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INTRODUCTION

More than three-quarters of the land in Canada is in the subarctic, or polar, region. In most of this region the soils are cold and the growing season is short. However, gardening can be successful (see Fig. 1) and profitable if you follow good gardening practices.

Fig. 1. Vegetables grown on permafrost. *Top row*: Lucullus chard, Copenhagen Early Market cabbage, Black Simpson lettuce. *Second row*: Ruby Queen beets, Scotch Curled kale, French Breakfast radish. *Third row:* Scarlet Nantes Coreless carrot, Super Snowball cauliflower, Italian Sprouting broccoli. *Bottom row*: Victory Neckless rutabaga, Warba potatoes, Purple Top Milan turnip.

[1] NRG Contribution No. 75-8

Gardening in the north is not easy, but the satisfaction from growing your own fruit and vegetables, the flavor of the first asparagus in spring, the crisp, succulent, fresh green salad ingredients straight from the garden, the soft green lawn surrounded by a riot of colors from carefully selected flowers, and the storage bins, freezers, and shelters full of fruit and vegetables are ample reward.

This publication includes information contained in Canada Department of Agriculture publications 1081, *Handbook for northern gardeners* by the late Frank S. Nowosad; 1192, *Gardening in the Yukon* by Gerard H. Gubbels; and the mimeograph *Gardening along the Mackenzie and Hay rivers* by R. E. Harris and A. J. Tosh. The experiences of many northern gardeners and the new techniques developed by scientists of the Canada Department of Agriculture during tests at Fort Simpson and Inuvik, N.W.T., Mile 1019, Y.T., and Fort Chimo, Que., are included. Some information from Publication 1408, *Gardening on permafrost* is included, but the latter publication should be referred to for more details on some special methods, especially in areas where cold soil is the main factor limiting plant growth.

PART I

CHOOSING THE SITE

If possible, choose a site that slopes gently toward the southwest. Deep sandy loams are ideal because they warm up fairly quickly, contain a good proportion of sand to clay, and usually have a good content of organic matter. Some gravelly and clay loams are also good because they warm up quickly in the spring, but they dry out faster and are often low in fertility. Clay and heavy clay loams are cold soils that are difficult to work, because they form hard lumps if they are dug or plowed when wet. Soils containing a lot of raw organic matter such as tree roots, undecomposed leaf litter, or moss can be made productive by removing some of the organic matter and adding nitrogen to speed up decomposition.

PREPARING THE SITE

Prepare the site as long before planting as possible. This allows the soil to warm up and mellow and the soil microorganisms to begin decomposing the organic matter and releasing minerals for plant growth.

Remove trees, shrubs, and large rocks from the planting area and from a strip 6 m (20 ft) wide around the garden. If possible, leave trees and shrubs on the west, north, and east to provide shelter from the wind. Shelterbelts lower the wind velocity by half, thereby reducing wind damage to plants and decreasing the loss of soil moisture by evaporation. Shelterbelts also increase soil and air temperatures by trapping heat from the sun.

To reduce the danger of frost, clear a path through the shelter at the lowest part of the garden to allow the heavy, cold air to move down the garden and be replaced by warm air from the upper parts of the slope (Fig. 2).

Where there are no trees, build a fence 1.2–1.8 m (4–6 ft) high around the garden. The fence will greatly improve the productivity of the garden.

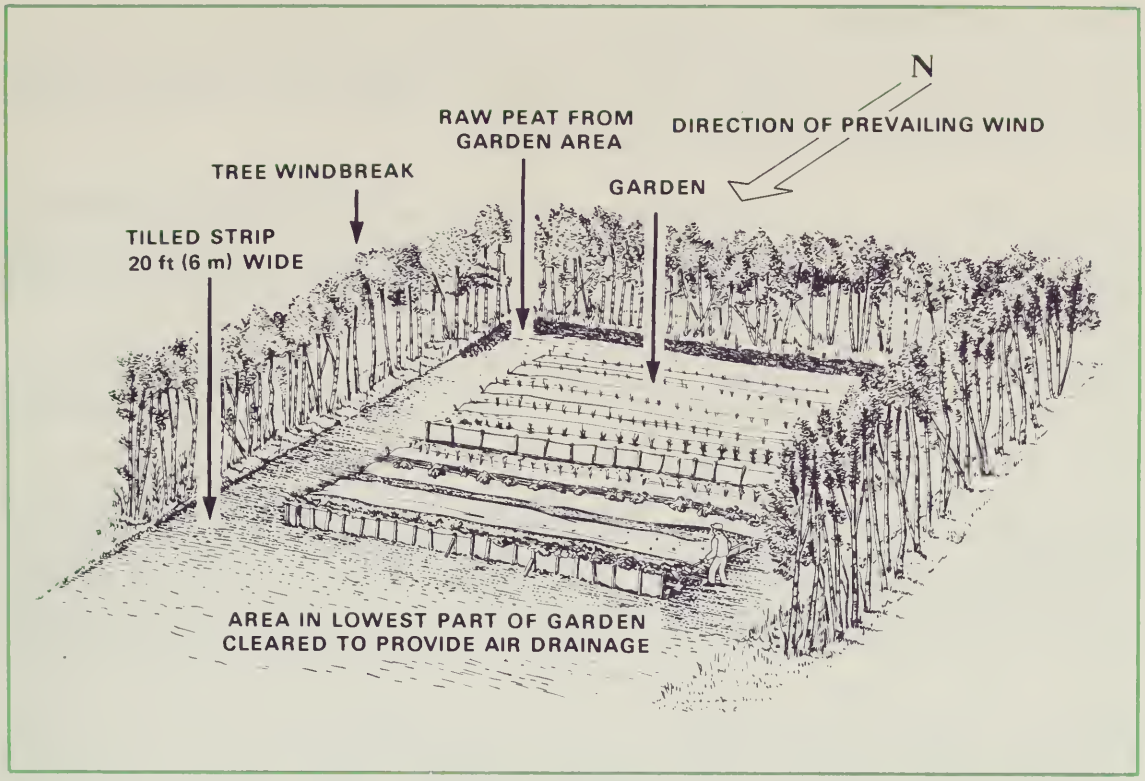


Fig. 2. A good garden area. In towns, the windbreak would be a fence.

Too much raw organic matter in the soil slows the warming of the soil in the spring. The microorganisms, which decompose the organic matter, use up the available nitrogen and prevent the plants from using it. Therefore, remove heavy layers of raw organic matter and pile them beside the garden to rot, but be sure to save all the decomposed organic matter.

Gravelly, sandy, and clay soils are greatly improved by the addition of decomposed organic matter. Spread 10–15 cm (4–6 in.) of organic matter over the surface of the garden and work it into the soil as long before planting as possible to enable microbial activity to start.

Dig or plow the garden in late fall and leave the surface rough. This allows air and water penetration, reduces runoff, and makes the soil easier to work in the spring.

SOIL FERTILITY

For optimum growth, plants must be able to obtain essential minerals from the soil in correct amounts. Soils vary in the amounts and ratios of minerals they contain. The only way of knowing how much of each mineral is present is to have the soil analyzed. Soil-testing services are provided by most provincial departments of agriculture for a small fee. Instructions for taking soil samples and containers for the samples are also available from the provincial departments.

Manure and compost

Well-rotted manure is an ideal soil amendment or conditioner. It opens up heavy clay soils, allowing air and water to penetrate faster. Manure also contains nitrogen, phosphorus, potassium, and other essential minerals.

Because manure is not available in most areas, well-rotted compost may be substituted. Compost is prepared by piling organic matter such as grass clippings, plant refuse, and peat moss into a heap to rot. In the north, rotting is very slow but with a little care it can be greatly speeded up.

Rotting is caused by microbes, which need heat, moisture, and nutrients to grow and increase. Locate the compost pile in a warm place in the garden to give the microbes a better chance to work.

To speed up the rotting, chop the organic matter into small pieces. If you have a large garden, it may be worthwhile to buy a shredder, but for most gardens the shredding can be done by hand with a sharp spade or shovel. Spread the chopped organic matter in layers about 15–20 cm (6–8 in.) deep and cover the surface with a nutrient mixture. The nutrient mixture can be a commercial compost maker, which contains nitrogen and hydrated lime, or a mixture of the ingredients given in Table 1. Water the organic matter and add a thin layer of garden soil or rotted manure to supply the microbes that decompose the compost. Continue to add layers of chopped organic matter, nutrient mixture, water, and soil until all the organic matter has been incorporated.

TABLE 1. A NUTRIENT MIXTURE FOR COMPOSTING

Nutrient	Formula	kg	(lb)
Sulfate of ammonia	21-0-0	18	(40)
Superphosphate	11-48-0	9	(20)
Muriate of potash	0-0-60	4.5	(10)
Ground limestone or	—	22.5	(50)
Unbleached wood ash	—	18	(40)

Thoroughly mix the ingredients and spread 2-3 kg (4-6 lb) of the mixture over each 45 kg (100 lb) of organic matter.

Water the pile occasionally to prevent it from drying out. It is advisable to leave a slight depression in the center of the pile to help hold the water. Turn the pile occasionally with a fork and shake the compost into fine pieces, or put it through a shredder. Add a little sulfate of ammonia and water as you turn the pile. Be sure the pile is well rotted before you apply it to the garden.

Lime

Do not add lime to the soil unless you are sure the soil is acid, or "sour." Because most soils in the Yukon Territory range from neutral to alkaline, liming is not recommended. However, some soils in the north need lime in order to grow good

vegetables. If the soil is acid, apply 1120–2240 kg/ha (1–2 tons/ac) or 230–500 g/m^2 (1/2–1 lb/sq yd) of agricultural ground limestone. Apply limestone in the fall, before plowing or digging.

Commercial fertilizers

Because barnyard manure is not usually available, you may use commercial fertilizers to fortify garden soils. The main reason for using commercial fertilizers is to ensure that food is available for the crops when they start growing. The use of commercial fertilizer is of particular value in colder regions, where the growing season is short.

The amount and kind of fertilizer needed vary according to the fertility of the soil and the food requirements of the plant. Leafy plants usually need more nitrogen and slightly less phosphorus and potassium than root crops. One fertilizer mixture cannot be expected to meet all conditions for all crops, but if it is impossible to have the soil analyzed, 10-30-10 at 7–11 kg/100 m^2 (15–25 lb/1000 sq ft) is a reasonable compromise. In sandy or gravelly soils increase the amount of fertilizer, and in heavy clay soils substitute 16-20-0.

Because the cost of transportation is high, it is advisable to use fairly concentrated forms of fertilizer. Higher numbers in the formulas mean that the concentration of essential elements is higher. The numbers are always printed in the same order on the label or bag. For example, a 10-30-10 fertilizer contains 10% nitrogen (N), 30% phosphate (P_2O_5), and 10% potash (K_2O).

The easiest way to apply fertilizer is by broadcasting. It should be done in early spring, before you cultivate the garden. The cultivating will mix the fertilizer into the soil.

Band fertilizing of row crops uses less fertilizer and places the fertilizer where it is most readily available to the plant, especially in the early stages of growth. However, banding requires a great deal more work and care than broadcasting. To ensure that the fertilizer does not come into contact with the seed, place the fertilizer 5 cm (2 in.) below and to the side of the seed. Make a seed trench 5 cm (2 in.) deeper and slightly wider than usual. Place a thin band of fertilizer along the bottom of one side of the trench and cover it with 5 cm (2 in.) of soil. Sow the seed in the usual way on the other side of the trench.

PLANNING THE GARDEN

Planning the garden can be fun and a great help when you order your supplies and equipment. Complete the plans long before spring.

Decide what you want to grow and the quantity of each. Consider the size of your garden and the amount of time you are prepared to devote to it.

Draw a plan showing each row, including the required spacings between plants, as given in Table 2. Place perennial vegetables such as rhubarb, asparagus, perennial onions, and chives along the side or end of the garden. If you have plenty of land, divide the garden into two parts. Plant vegetables in the alternate half each year. To

increase the organic matter, plant fall rye, field peas, or other cover crops in the other half and dig them in.

Refer to Table 2 to determine the amount of seed or plants of the varieties you wish to grow.

Order early.

GROWING TRANSPLANTS

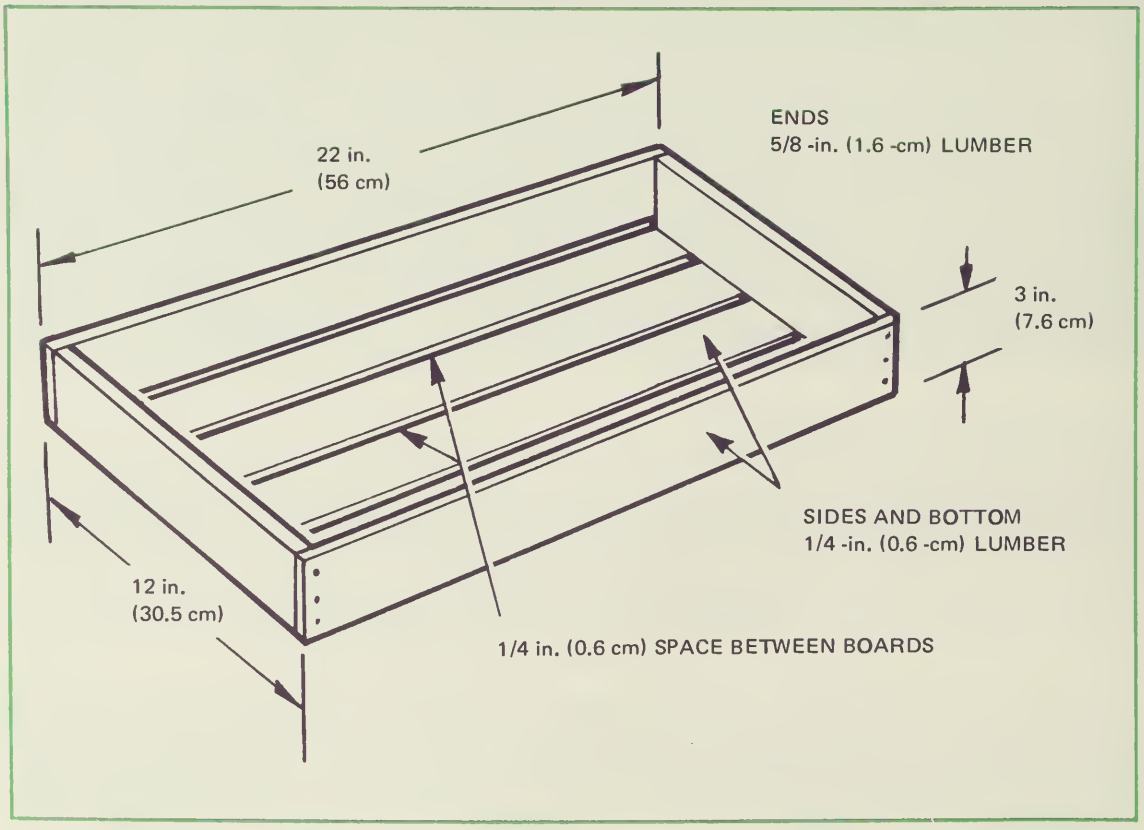
Cabbage, cauliflower, broccoli, kale, Brussels sprouts, and tomatoes are grown under cover for 6–8 weeks before they are transplanted to the garden. In some areas successful crops of head lettuce, corn, cucumbers, squash, and other crops can also be grown from transplants.

Transplants can be grown in a sunny window, cold frame, hotbed, plastic crop shelter, greenhouse, or any combination of two, or more. The various types of structures used for growing transplants are described in Part II of this publication.

The most commonly used containers for growing transplants are shallow wooden boxes, usually called flats (Fig. 3).

The use of an individual container for each plant is becoming a popular practice because the plants can be transplanted without disturbing the roots. Peat pots,

Fig. 3. A convenient size of flat.



plant bands, paper and plastic drinking cups, and soup tins are also useful. When you use cups or tins, remember to punch holes in the bottom of them for drainage. Individual containers are usually placed in a flat for convenience in handling.

In the fall before freeze-up, collect as much good sandy loam topsoil, well-decomposed peat or compost, and sand as you will need to fill your containers. Store them in a convenient place. During the winter build the flats and collect the plastic and paper drinking cups or soup cans, or order peat pots or plant bands. Order all your supplies and seeds early and store them in a cool, dry place.

Two weeks before seeding, move the potting soil and sand inside to thaw. When they have thawed, thoroughly mix 2 parts of soil, 1 part of peat or compost, 1 part of sand. For each 10 L of the mixture, add 10 g of a 10-52-10 plant-starter fertilizer. Add enough water to wet the soil thoroughly. Punch drainage holes in the bottom of the paper and plastic cups and tins. Where necessary, place a sheet of newspaper in the bottom of flats and other containers to prevent the soil from coming out the bottom. Fill the containers. Gently firm the soil and level the surface, leaving the soil level 6 mm (1/4 in.) below the top of the container.

Sow the seed in one of the following ways:

- Spread the seeds evenly over the surface of a flat or a large can, gently press the seeds into the soil with a small piece of lumber, and cover the seeds with 3 mm (1/8 in.) of soil or sand. When the seedlings have two true leaves (Fig. 4), transplant them to individual containers or space them out evenly in a flat.
- Sow two or three seeds in each container. When the seedlings have two true leaves, remove all but the most vigorous plant in each container. (This method is best for beginners.)

Fig. 4. Cabbage seedlings ready to be thinned out. The two large heart-shaped leaves are the seed leaves, or cotyledons, and the small leaf between the seed leaves is the first true leaf.

Keep the containers in a warm place, preferably at 21–24°C (70–75°F). As soon as the plants appear, give them as much light as possible. If they are growing in a window, turn the containers every day to assure even, upright growth. If the plants start to grow tall and leggy, increase the amount of light, or reduce the temperature, or both.

At all times keep the soil moist but not wet. Overwatering causes the seed to rot and sometimes causes damping-off of the plants. If some plants die, stop watering and allow the surface of the soil to dry out, or sprinkle a little dry sand over the surface. Stir up the surface occasionally.

Water the plants once a week with a small amount of solution made by dissolving 28 g (1 oz) of 16-20-0 fertilizer in 4.5 litres (1 gal) of water.

When daytime temperatures are above 16°C (60°F) move the plants outside. If you do not have cold frames, move the plants back inside when the temperature drops below 10°C (50°F). If you have cold frames, put the plants in them and cover them with glass. If there is danger of frost at night, cover the cold frames with blankets, or provide enough heat to prevent the plants from freezing.

For the first few days that the plants are outside, shade them from direct exposure to the rays of the sun during the middle of the day. Gradually increase the amount of exposure until they can be given full sun.

When it is warm enough outside, set the plants out in the garden. Several hours before transplanting, water the plants thoroughly. Transplant on a dull day or in the evening. Remove the plants from cups, tins, and plant bands, or dig them from flats, keeping as much soil as possible on the roots. Dig a hole large enough to bury all the roots, and place the plants a little deeper in the soil than they were in the containers. Fill in around the plant with good topsoil, firm the soil around the roots, and water each plant with 0.6 litre (1 pt) of a solution containing 28 g (1 oz) of 16-20-0 fertilizer in 4.5 litres (1 gal) of water.

DIRECT SEEDING IN THE GARDEN

Radishes, leaf lettuce, beets, chard, summer turnips, spinach, rutabagas, peas, and carrots can be successfully grown in most areas from seed planted directly in the garden.

When the soil temperature is above 5.6°C (42°F), early vegetables can be seeded directly in shallow trenches. String a tight line or place a long board along the row, and with a pointed stick or the edge of a rake or hoe make a shallow trench along the line or board. The correct depth for seeding each vegetable is given in Table 2. If the fertilizer is going to be banded, make the trench 5 cm (2 in.) deeper and slightly wider, and apply the fertilizer as recommended on page 9.

The trench should be the same depth all along the row so that the seeds will be covered evenly.

If the soil is not damp at the bottom of the trench, deepen the trench until moisture appears and after you have sown the seed only partly fill in the trench, or

make the trench the proper depth and sprinkle water along the bottom of the trench to moisten the soil.

Sow seeds only slightly thicker than is necessary to get a good even stand at the desired spacings. By seeding too heavily you waste seed and give yourself more work at thinning time. Where garden space is limited, crops such as radishes, carrots, beets, leaf lettuce, spinach, chard, and summer turnips can be sown thicker than usual and when the extra plants are thinned out, they can be used for early crops. As the plants grow, remove every second plant until the desired spacing is reached.

Sow small seeds, such as carrots and lettuce, directly from the package by tearing off a corner and gently tapping the envelope with your finger as you move along the row. Sow large seeds, such as peas, individually at the specified spacing.

The emergence of seeds can be speeded up by presprouting them. Place the seeds on damp paper towels in a room at 16–21°C (60–70°F). Keep the paper damp and examine the seeds every morning. Sow the seeds just as soon as the first roots, or radicles, appear. If the radicles become too long, many of the seeds will die (Fig. 5). Presprouted seeds are also useful for starting transplants.

Cover the seed and press the soil firmly over it. This can be done by placing a long, narrow board over the row and walking along it, or by tramping along the row, or by pressing firmly along the row with the back of a rake. After you have firmed the soil, rake it lightly to get an even cover over the seeds and to provide a shallow mulch.

Fig. 5. *Above*: Sprouted seeds with radicles just appearing. These seeds are ready to be planted. Below: Sprouted seeds with long radicles. If planted in this condition many of the seeds will die.

TABLE 2. SOME VARIETIES OF VEGETABLES FOR NORTHERN GARDENS, AND RECOMMENDATIONS FOR SEEDING AND PLANTING

Kind	Variety	Amount of seed or number of plants per 15-m (50-ft) row		Distance between rows		Distance between plants in row		Depth to cover seed		Remarks
		(g)	(oz)	cm	(in.)	cm	(in.)	cm	(in.)	
Cool season crops — seeded directly in the garden										
Beets	Detroit Dark Red, Flat Egyptian, Ruby Queen	14	(1/2)	50	(20)	3.8	(1.5)	1.3	(1/2)	
Beans, broad	Broad Windsor, Sutton Giant Windsor	170	(6)	60	(24)	20	(8)	5	(2)	
Carrots	Red Cored Chantenay, Scarlet Nantes Coreless	7	(1/4)	50	(20)	3.8	(1.5)	1.3	(1/2)	
Chard	Lucullus, Rhubarb	14	(1/2)	60	(24)	18	(7)	1.3	(1/2)	
Chinese cabbage	Michihli	7	(1/4)	50	(20)	20	(8)	0.7	(1/4)	
Endive	Deep Heart, Fringed, Green Curled	1 pkt.	—	50	(20)	19	(7.5)	0.7	(1/4)	
Kohlrabi	Early White Vienna, Giant of Prague	14	(1/2)	70	(28)	12	(5)	0.7	(1/4)	
Lettuce, head	Great Lakes, Imperial, New York	1 pkt.	—	45	(18)	30	(12)	0.7	(1/4)	or use transplants
leaf	Black Simpson, Grand Rapids, Paris Island Cos, Salad Bowl	1 pkt.	—	45	(18)	15	(6)	0.7	(1/4)	or use transplants
Onion sets	Ebenezer, Sweet Spanish	680	(24)	45	(18)	7.6	(3)	2.5	(1)	
Parsnips	Guernsey, Harris Model, Hollow Crown, Short Thick	7	(1/4)	60	(24)	9	(3.5)	1.3	(1/2)	must be planted very early
Peas, early	Alaska, Little Marvel	113	(4)	75	(30)	5	(2)	5	(2)	
main crop	Director, Laxton's Progress, Lincoln, Selkirk Tall Telephone									
Radishes	Cherry Belle, French Breakfast, Saxa, Scarlet Globe, White Icicle	14	(1/2)	30	(12)	2.5	(1)	0.7	(1/4)	
Rutabagas (Swedes)	Canadian Gem, Laurentian, Victory Neckless	14	(1/2)	84	(33)	18	(7)	0.7	(1/4)	
Spinach	Bloomsdale, New Zealand	14	(1/2)	50	(20)	12	(5)	1.3	(1/2)	
Turnips, summer	Early White Milan, Golden Ball, Purple Top Milan	14	(1/2)	70	(28)	12	(5)	0.7	(1/4)	
Cool season crops — started inside and transplanted to the garden										
Broccoli	Calabrese, Green Mountain, Italian Sprouting, Waltham 29	1 pkt.	—	75	(30)	45	(18)	0.7	(1/4)	
Brussels sprouts	Jade Cross	1 pkt.	—	75	(30)	45	(18)	0.7	(1/4)	
Cabbage, early	Copenhagen Early Market, Early Greenball, Early Wonder, Viking Extra Early	1 pkt.	—	75	(30)	45	(18)	0.7	(1/4)	
midseason	Bonanza, Golden Acre									
late	Copenhagen Late Market, Pennstate Ballhead									
Cauliflower	Snowball, Snow Drift, Snow Queen	1 pkt.	—	75	(30)	45	(18)	0.7	(1/4)	
Celery	Golden Plume, Utah # 15	1 pkt.	—	71	(28)	15	(6)	0.7	(1/4)	

Kale	Scotch Curled	1 pkt.	—	75	(30)	45	(18)	0.7	(1/4)	
Onions	Autumn Spice, Sweet Spanish	1 pkt.	—	38	(15)	8	(3)	0.7	(1/4)	
Warm season crops that produce satisfactorily in some years from direct seeding or transplanting in the garden, but produce better if transplanted into clear polyethylene mulches in locations protected from the wind										
Beans, bush wax	Pencil Pod Wax, Round Pod Kidney Wax, Top Notch Golden Wax	227	(8)	53	(21)	7.6	(3)	5	(2)	
green pole	Garden Green, Slender Green Blue Lake, Early Wonder Wax	113	(4)	90	(36)	45	(18)	5	(2)	
Corn	Arctic First, Dorinny, Golden Midget, J-6 Cross, Pickaninny	113	(4)	84	(33)	25	(10)	5	(2)	
Cucumbers, pickling	Early Russian	4	(1/8)	106	(42)	60	(24)	1.3	(1/2)	or use transplants
slicing	Marketer, Mincu, Straight Eight, Surecrop Hybrid									
Marrows	Blackinni, Long Bush White, Zucchini	28	(1)	190	(75)	60	(24)	2.5	(1)	
Potatoes	Norgold Russet, Norland, Warba	7 kg	(15 lb)	84	(33)	28	(11)	—	—	
Pumpkins	Jack O'Lantern, Small Sugar	28	(1)	190	(75)	60	(24)	2.5	(1)	
Squash	Buttercup, Early Prolific, Hubbard, Table Queen	28	(1)	190	(75)	60	(24)	2.5	(1)	
Tomatoes	Early Sub-Arctic, Sub-Arctic Maxi, Sub-Arctic Plenty, Swift	25 plants	—	90	(36)	60	(24)	0.7	(1/4)	
Warm season crops that only produce satisfactorily if transplanted into unheated or heated greenhouses or shelters										
Cantaloupes	Sampson Hybrid, Sugar Salmon	1 pkt.	—	107	(42)	60	(24)	2.5	(1)	
Eggplants	Burpee Hybrid, Morden Midget	1 pkt.	—	71	(28)	30	(12)	1.3	(1/2)	
Peppers	Earliest Red (sweet), Long Thick Red (hot)	1 pkt.	—	71	(28)	30	(12)	1.3	(1/2)	
Watermelons	Market Midget, Sugar Hybrid	1 pkt.	—	112	(44)	60	(24)	2.5	(1)	pollinate by hand
Herbs										
A large number of herbs including aleriac, anis, basil, caraway, catmint, chicory, coriander, dill, endive, fennel, marjoram, oregano, parsley, peppergrass, rosemary, sage, salsify, savory, thyme		1 pkt.	—	45	(18)	15	(6)	0.6	(1/4)	
Perennial vegetables										
Asparagus	Martha Washington	1 pkt.	—	137	(54)	71	(28)	1.8	(3/4)	
Chives		50 sets	—	75	(30)	25	(10)	—	—	
Horseradish		25 plants	—	90	(36)	60	(24)	—	—	
Onions		50 sets	—	75	(30)	25	(10)	—	—	
Rhubarb	Canada Red, Macdonald, Ruby	1 pkt.	—	168	(66)	168	(66)	1.8	(3/4)	

If it is sunny and warm when you are seeding, do not leave the trenches open any longer than necessary, because valuable soil moisture will evaporate. Open, sow, fill, firm, and rake one row at a time.

The harvesting season for fast-growing vegetables such as radishes, lettuce, beets, and spinach can be extended by

sowing two or three varieties that mature at different rates (sow them on the same date and they will be ready to use several days apart) or

sowing the same variety at 10- to 14-day intervals.

POTATO GROWING

Potatoes grow from tubers and require a different method of planting. Use only tubers that are Certified seed potatoes. Store them at about 3°C (38°F) until a week before they are to be planted in the garden. Cut the large tubers into pieces of 56–113 g (2–4 oz), each piece having at least one eye, and plant them in the garden about 30 cm (1 ft) apart.

Earlier potatoes can be obtained from seed pieces that have been presprouted. Take the tubers out of storage about 3 weeks before planting and cut them into pieces. Place the pieces in damp sand or well-decomposed peat in a warm place where there is bright light. Keep the sand or peat moist. In 3 weeks the dark green sprouts should be about 13–19 mm (1/2–3/4 in.) long. Put them outside to harden off for a few days. Plant them as shallow as possible, or even place them on top of the ground and cover the seed pieces with soil. With this method great care must be taken not to break off any roots or sprouts during planting, to plant the tubers in damp soil, and to keep the soil moist in the rooting zone at all times.

Cool soils restrict potato productivity. Ridging, terracing, and the use of polyethylene mulches will greatly increase yield in cool soils. For more information on these methods see page 17 of this publication and *Gardening on permafrost.*

If you use eyes or small pieces of potato for seed, you can increase yields by starting the potatoes indoors and treating them as transplants.

CARING FOR THE GARDEN

Keep the soil in the unplanted spaces and between the rows cultivated at all times. Cultivation helps to warm up the soil, to reduce water loss, and to kill weeds. Cultivate only 13 mm (1/2 in.) deep close to the plants, and do not injure the roots. Remove all weeds.

Watch the plants for damage by insects and diseases. Most insects and diseases can be controlled with chemicals. Consult your agricultural representative or provincial department of agriculture for recommendations. All insects and diseases should be controlled as soon as they are noticed, otherwise they may cause a lot of damage in a short time.

Thin and space the plants when the first true leaves develop. As the potato plants develop hill them up gradually until they begin to bloom, then mound them up and leave them undisturbed until they are harvested.

As soon as the crop is harvested take soil samples, dry them, and send them away for analysis. Spread refuse, such as green leaves, grass, and compost, or decomposed peat evenly over the garden. Plow or dig the garden, and bury the refuse. Leave the surface rough.

Collect soil, flats, and other containers so that you will be ready for the next year.

KINDS AND VARIETIES OF VEGETABLES

The varieties of vegetables listed in Table 2 have been successful in many gardens. These varieties should be the mainstay of your garden, especially if you are a beginner. More experienced gardeners should try a few new varieties each year.

PART II

SPECIAL METHODS

Although many garden crops can be grown by the methods already described, special techniques must be used in areas that have more severe climates. These methods can also be used to extend the harvesting period and to increase the number of crops that can be grown in almost all areas. The following special methods are described in order, starting with the least complicated that requires the least equipment.

RIDGING, TERRACING, AND MULCHING

Ridging and terracing increase soil temperatures by as much as 2.2°C (4°F), clear polyethylene mulches by 7°C (12°F), and a combination of ridging or terracing and polyethylene mulches by as much as 9°C (16°F) (Fig. 6). These methods are very effective for growing many crops, especially potatoes, carrots, and rutabagas, on cold soil. Methods for building ridges and terraces and laying polyethylene mulches are described in *Gardening on permafrost.*

Black polyethylene mulches smother weeds but do not increase the soil temperature as much as clear polyethylene mulches. Both black and clear plastic are beneficial in dry weather for conserving moisture, preventing the soil from packing during heavy rains, and reducing spotting and soiling of fruit and vegetables. Use polyethylene that is 0.9 m (3 ft) wide and 0.03 or 0.05 mm (1.5 or 2 mil) thick for good results at a reasonable cost.

Do not use straw, manure, sawdust, or other organic mulches in cold soils, because they insulate against the sun and decrease soil temperatures.

Fig. 6. Vegetables growing in ridges and terraces in the garden of the Research Substation, Inuvik, Northwest Territories. Notice the natural windbreak in the background.

ROW COVERINGS

Clear plastic can be used in place of individual wax-paper plant protectors to cover rows of plants. As with larger shelters, row coverings can be used in conjunction with a cold frame or a hotbed.

The most convenient type of support for row coverings is shown in Fig. 7. The wire between the stake and first support prevents the supports from bending into the row, and helps in stretching and keeping the plastic taut.

Most row covers are made from polyethylene that is 0.9 m (3 ft) wide and 0.05 mm (2 mil) thick. For taller plants use taller supports and two strips of plastic, one on each side and overlapping at the top by about 10 cm (4 in.).

Apply the row coverings after the seeds or transplants have been planted. On a windless day, place clear polyethylene over the supports and pull it tight. Bury all the edges in shallow trenches and firmly anchor them with soil to prevent the wind from getting under the plastic and blowing it away. If you use two sheets of plastic, draw the sheets tight at the top of the supports so that the overlap stays closed. Pin the two sheets together at each smooth support with a 5 cm (2 in.) finishing nail. Use a piece of plastic 8 X 10 cm (3 X 4 in.) as a reinforcement at the point of pinning. Do not pin the sheets together over the notched supports so that the edges of the sheet can be pulled over the notches for ventilating, working with the plants, or allowing rain to enter.

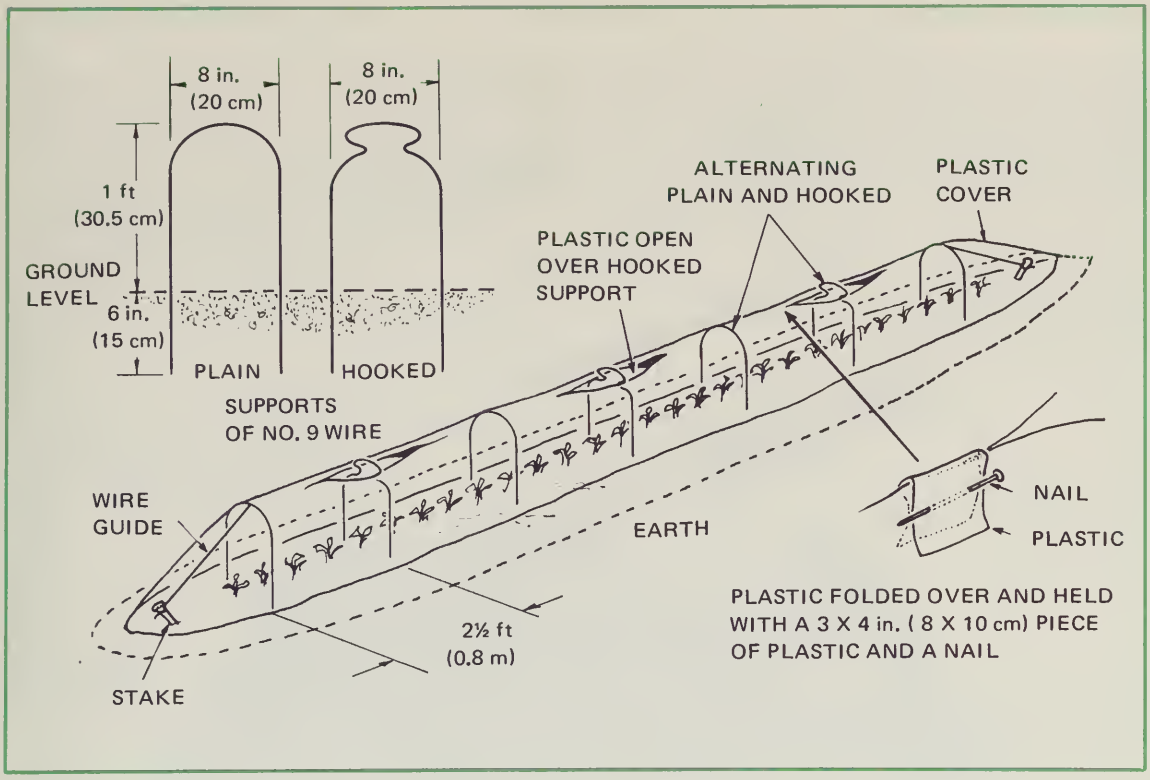


Fig. 7. Row tents for covering small plants.

After the plants have emerged under the standard-sized row cover, cut 38 cm (15 in.) slits over the hooked supports. To prevent the slits from being torn larger by the wind, pin a tuck in the plastic at both ends of the cut.

Ventilate the rows by pulling the edges of the plastic over the notches in the support. On cool days leave all vents closed, and as the temperature rises increase the number of open vents. Close all vents on frosty nights, and if the temperature is expected to go below freezing cover the rows with tarpaulins or blankets.

When the plants reach the top of the plastic, open the plastic all along the rows and pin it along the sides of the support.

COLD FRAMES

Cold frames are used to harden plants and prepare them for planting in the garden, and also to grow early crops. The standard size of cold frame is built of planks 5 cm (2 in.) thick and covered with glass or plastic sashes (Fig. 8). One wall should be higher than the others so that the sashes slope, causing the water to run off and increasing the exposure to the sun. Although the standard size of cold frame is most common, a cold frame can be built any convenient size that suits the type of sash available. Glass, synthetic glass, or clear plastic sheeting can be used on the sashes.

Satisfactory cold frames can be made from logs. The logs must be chinked and well banked with soil on the outside, and lined with tar or roofing paper on the inside.

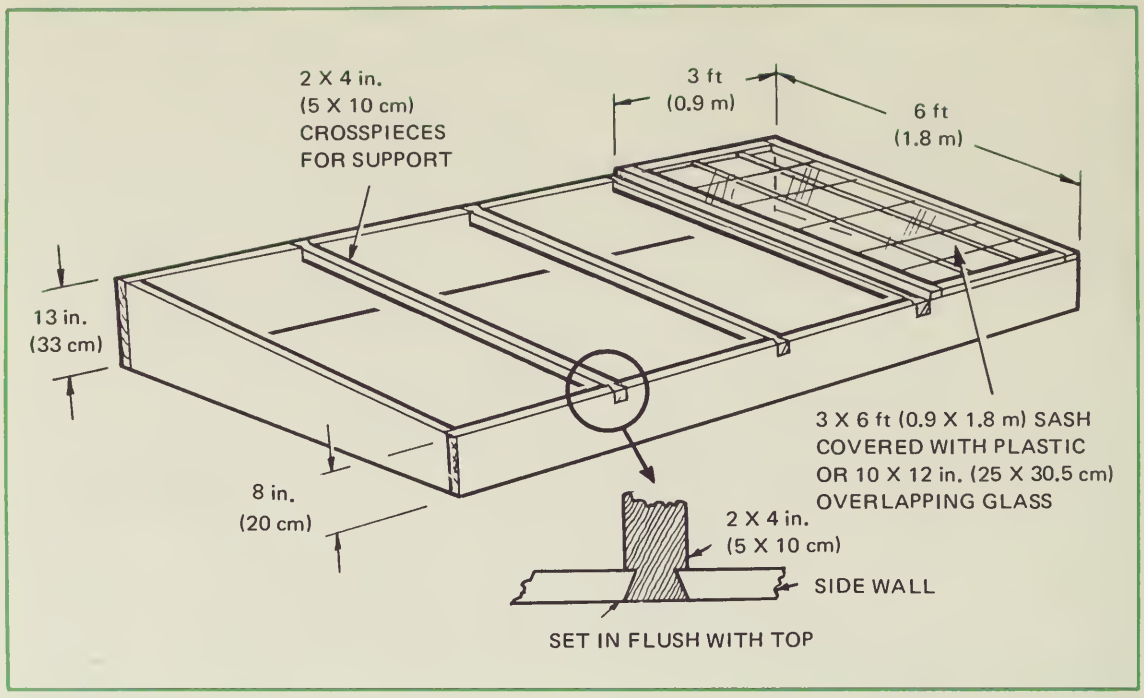


Fig. 8. A cold frame with 0.9 x 1.8 m (3 x 6 ft) glass sashes.

Locate the cold frame in a sheltered spot protected from the prevailing winds but with a good exposure to the sun. Bank the sides well with earth.

If the cold frame is only going to be used for hardening plants, put 5 cm (2 in.) of fine gravel in the bottom of it and place the flats and containers on the gravel.

If the frame is going to be used to grow early crops, fill it with 15–20 cm (6–8 in.) of good soil. A much simpler type of frame for growing crops is described in *Gardening on permafrost.*

When the sun is strong, the temperature in the cold frame may rise above 38°C (100°F) and kill or damage the plants. Ventilate the frames by sliding the sashes down and leaving an open space at the top. Adjust the size of the opening to keep the temperature between 18 and 27°C (65 and 80°F).

HOTBEDS

Hotbeds are used to start early plants and grow them until they are large enough to place in cold frames. They are also used to grow crops to maturity. Seed can be sown in a hotbed as soon as the sun is warm, which may be 5 or 6 weeks earlier than plants can be safely grown outdoors. The time to start can be determined from weather records and trial and error.

Hotbeds are built the same as cold frames and should be located and managed the same way. The only difference between the two is that hotbeds are heated with manure or electricity.

Heating with manure

Fresh horse manure is a good source of heat. Pile the manure either on the surface of the ground or in a hole (Figs. 9 and 10). The advantage of using a hole is that the frame is placed snugly on the manure and does not extend high enough above the ground to be exposed to cold spring winds; the disadvantage is that in the north the ground may still be frozen.

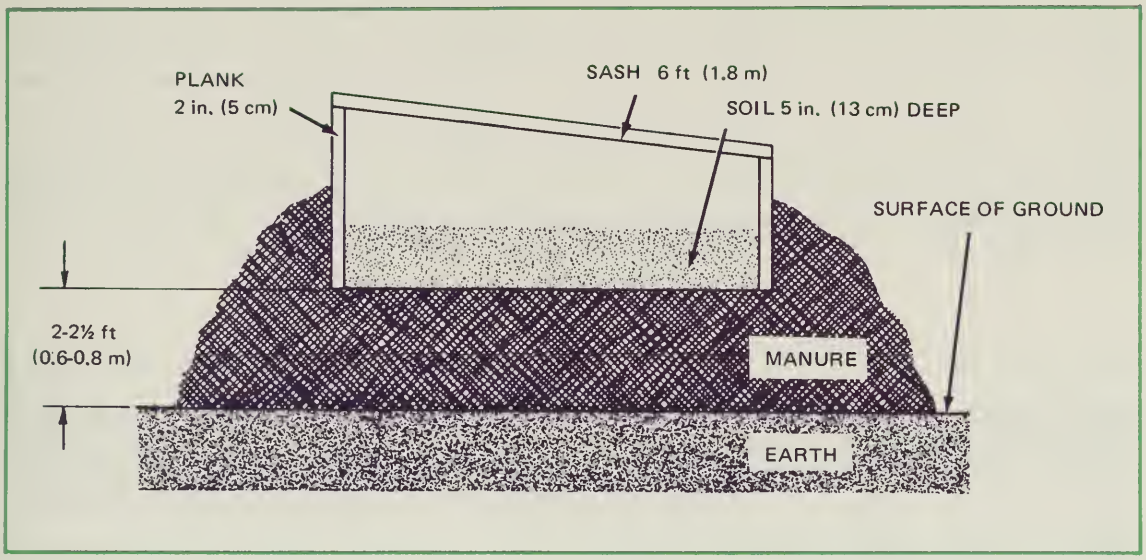


Fig. 9. A surface hotbed in cross section.

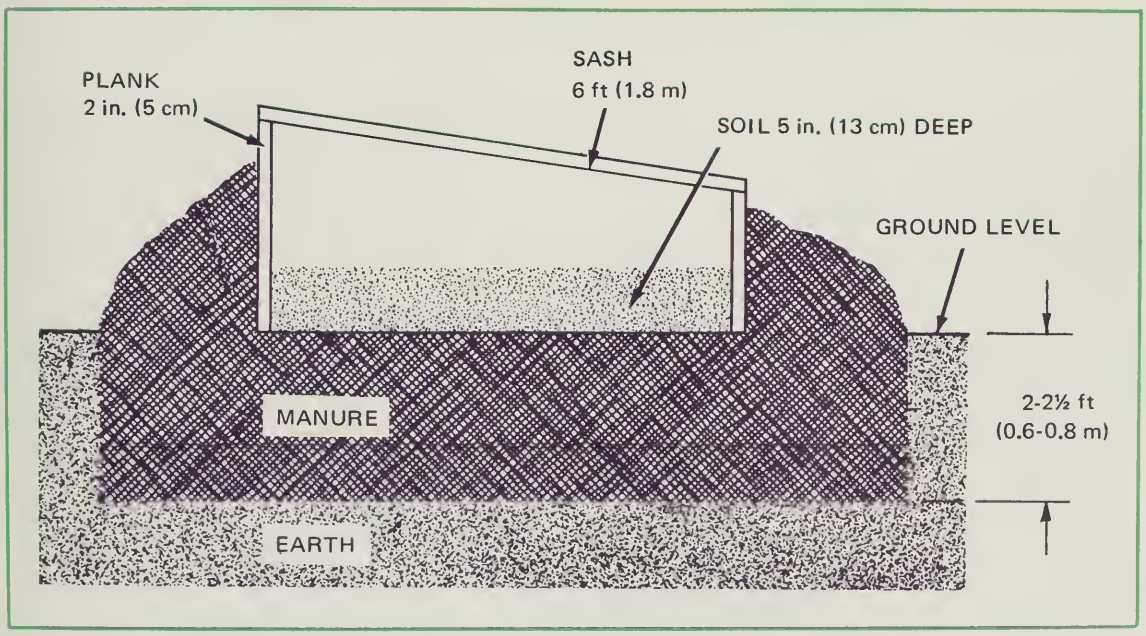


Fig. 10. A pit hotbed in cross section.

Leave the manure in the pit or pile for 5 days, then fork it over, shake it out well, and build the pile up evenly. Water very dry manure to prevent excessive heating

and settling of the bed. Tramp the manure to make sure that there are no slack spots. Place the frames on the manure, and cover them with sashes. Leave the sashes on for a few days, then open them slightly so that the gases that form from the early heating will escape. Put in about 13 cm (5 in.) of good soil over the manure. When the temperature of the manure goes down to 26.7°C (80°F), place the flats in the hotbed, or plant the seed in the earth. If flats are used, less soil is needed. Set the flats on narrow boards across the bed. When frosty nights are expected and the beds have little bottom heat, cover the frames with old carpets, rugs, or straw.

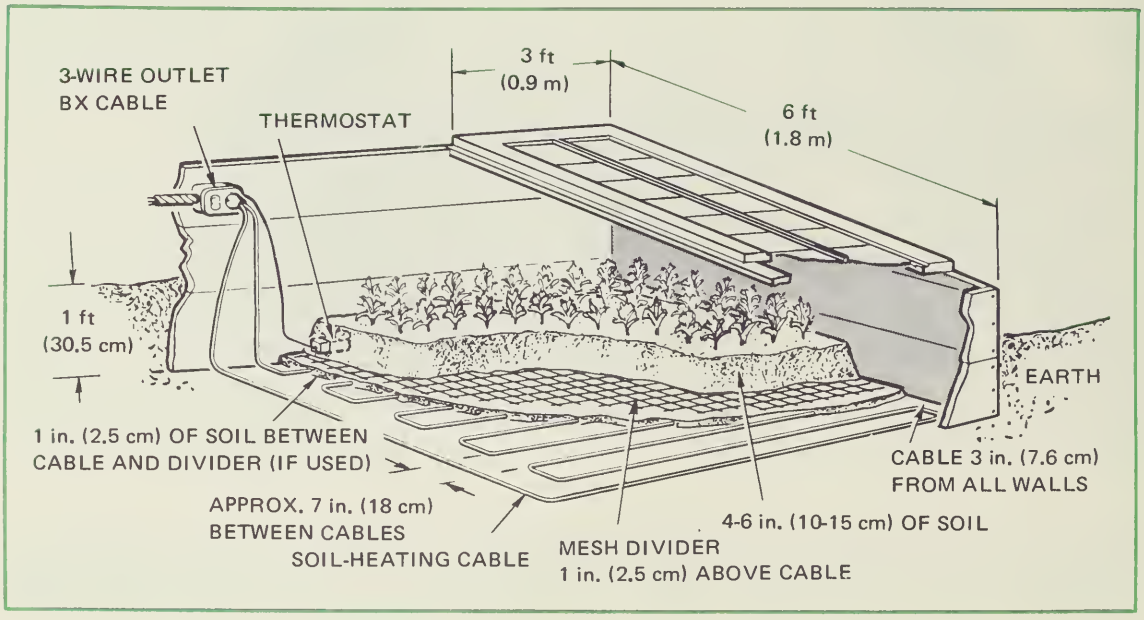
Because of the limited air space in a hotbed, the temperature will rise quickly on a bright day and the plants may easily be ruined by too much heat. To avoid this, push the sashes back a few inches, the exact amount depending on the weather and the kind of plants. For example, tomatoes can withstand a higher temperature than cabbages. Water the plants carefully to avoid too high humidity and to prevent the development of damping-off fungi. The best time to water is about noon, because the surface of the soil and the air have time to dry out before the sash is closed for the night.

Heating with electricity

When manure is not available as a source of heat and where electric power is accessible, heating cables and thermostats can be used (Fig. 11). One heating-cable set 18 m (60 ft) long will heat a standard 1.8 X 1.8 m (6 X 6 ft) frame, and one thermostat will regulate two such heating cables. Bury the thermostat in the soil, following the manufacturer's directions.

Put the hotbed frame in a pit at least 30 cm (a foot) deep, and pack soil around the outside. Level the surface of the soil inside the frame and spread about 2.5 cm (an inch) of sand over the surface. Lay out the cable and cover it with another 2.5 cm (inch) of sand. Place 13–25 mm (1/2–1 in.) mesh wire screening over the sand to protect the cable when the soil is being worked. Put flats and pots directly on the

Fig. 11. A heating cable in place in a hotbed.



wire screening, but if seeds are to be planted in the frame spread 10–15 cm (4–6 in.) of good soil over the wire screening and seed directly in the soil.

Electrically heated hotbeds, need more water than manure beds. Keep the soil moist, but not wet, down to the cables.

For most seedlings set the thermostat at about 18°C (65°F). For accuracy use a soil thermometer. You also need an air thermometer to record the temperature of the air inside the hotbed when the sun is fully out. Open the sashes during the day, and close them in the evening to save the accumulated heat. If the temperature is near freezing outside, an additional cover of canvas, jute bags, or other materials may be needed during the night.

To eliminate drafts it is important to have the hotbed banked with soil. When plants are well started and spaced in flats or pots, and if weather permits, remove the sashes for part of each day in order to harden the plants before setting them out in the open garden.

SHELTERS AND HUTCHES

Shelters and hutches are walk-in row coverings or portable unheated greenhouses that are covered with plastic sheeting. They are usually left in place until the crop is harvested, to protect the plants throughout the season.

Shelters and hutches can be made of 2.5 X 5 cm (1 X 2 in.) or 5 X 5 cm (2 X 2 in.) softwood lumber, similar to a greenhouse, but a more convenient method is to

Fig. 12. Wooden panels covered with polyethylene used in building various types of crop shelters.

build them of portable sashes covered with plastic (Fig. 12). These can be dismantled and stored when they are not in use and kept ready for the next year. A very handy shelter is described in Canada Department of Agriculture Publication 1337, *How to build a plastic crop shelter or greenhouse.* Commercial metal-framed portable shelters are also available. These shelters last longer, but their initial cost is higher.

Sow the low-growing crops along the sides of the shelter before you put the panels in place, and the taller crops down the center after the panels are in place. For example, you could plant beans along the sides, and tomatoes and dwarf corn down the center.

It is important not to puncture or tear the plastic, because once it has been torn it will continue to tear in the wind. It is advisable to have mending tape handy for patching small tears or punctures. Watch the temperature while the sun is fully out, and ventilate by opening the door and the ventilators at both ends.

Some plants, such as cucumbers and tomatoes, must be hand-pollinated to set fruit, because there are usually not enough insects inside the plastic shelters to do the pollinating. To hand-pollinate cucumbers, transfer pollen from male flowers to the stigma of the female flower with a soft camel's-hair brush. Pollinate each female flower several times, starting when the flower first opens and using pollen from several male flowers. To pollinate tomatoes, tap the flower clusters or shake the branch two or three times a day, beginning soon after the first flower opens.

GREENHOUSES

This is an extensive topic that cannot be described in detail in this publication. For more details on how to build a glass-covered greenhouse and the culture of plants, obtain a copy of the British Columbia Department of Agriculture Publication 71-2, *Small greenhouses,* or one of the many books available on these subjects.

Greenhouses are used for starting seedlings and growing transplants until the plants are big enough to be moved to cold frames or row shelters, and then they can be used to grow warm season crops, such as tomatoes, cucumbers, beans, and corn, or early crops of other vegetables to maturity. For early crops in the greenhouse, sow the seed in rows and place the plants that are to be moved to cold frames and row shelters between the rows. Before the plants are big enough to cause too much shading, move the transplants to cold frames or row shelters.

Because of the short days and low temperatures during the winter, greenhouses are seldom used throughout the year. To grow plants during the winter it would probably be more economical to grow them under lights in an insulated room or cabinet.

Permanent glasshouses are probably the best, but they are expensive to buy and transport into remote northern regions. The upkeep of glass, paint, and putty is also a big expense. Consequently, only plastic-covered houses are described in this publication. Two types are described.

Peaked-roof frame

This is the most common and versatile type, because the size and height of the house can be changed to suit your needs. Most small greenhouses are made of 5 X 5 cm (2 X 2 in.) lumber nailed to 5 X 10 cm (2 X 4 in.) plates (Fig. 13). For larger houses, thicker side walls and rafters must be used.

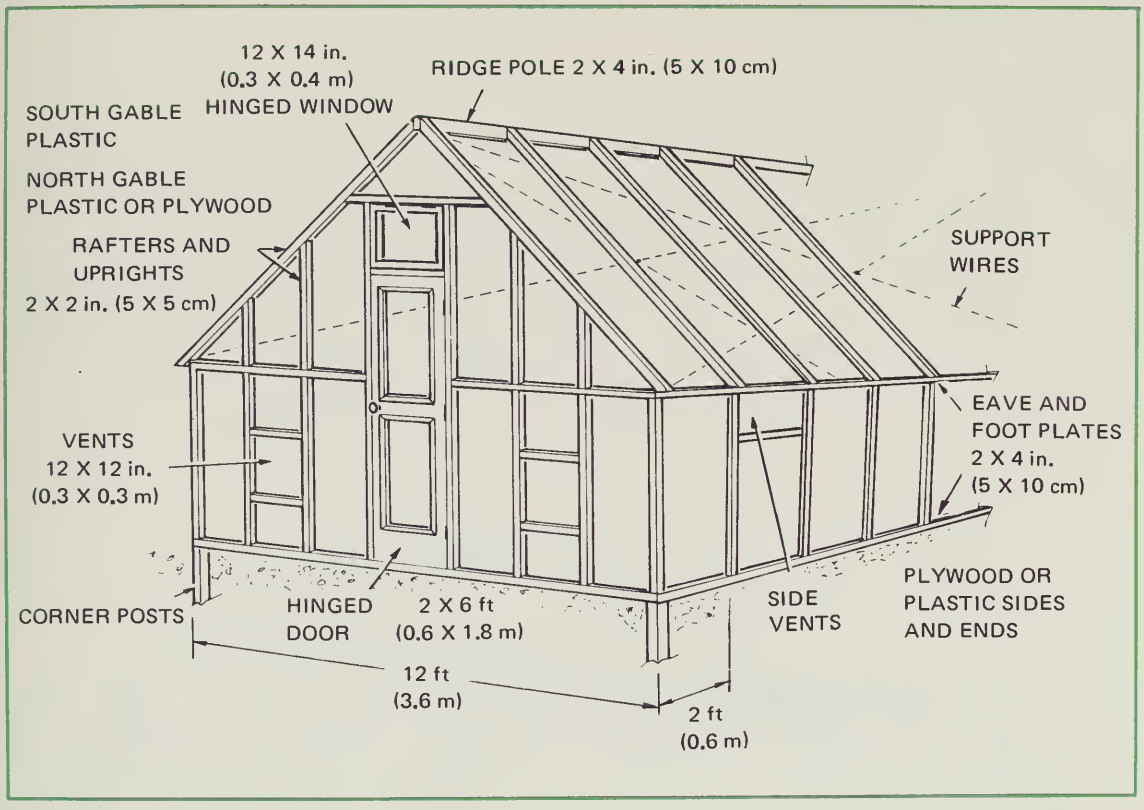


Fig. 13. One type of homemade greenhouse that can be covered with plastic.

The foundation can be made of concrete, logs, or other suitable material. To reduce heaving, place posts at each corner and embed or bolt them to the bottom plate. The side walls should be high enough to allow you to work comfortably in the house. Side wall supports and roof rafters can be spaced further than 0.6 m (2 ft) apart but the danger of the plastic tearing in the wind increases as the distance between uprights is increased. If the plants are to be grown on benches, the side walls can be covered with 6 mm (1/4 in.) plywood up to the height of the benches, but if the plants are to be grown on the ground, the sides should be lined with plastic. A layer of plywood or plastic should be placed on both the inside and the outside of the uprights to provide a 5 cm (2 in.) layer of insulation. The eaves should be at an angle of 40° to allow the snow to slide easily off the roof.

The side walls (if they are plastic) and the roof must be braced. On each of the side walls, run braces diagonally from both ends of the eave plate to the opposite ends of the foot plate. Run similar braces from the ends of the ridgepole to the opposite ends of the eave plate. Braces made of No. 9 wire are better than wooden braces, because they give adequate support without shading the plants. Put a turn buckle

on each wire for tightening the wires. Install the braces on the inside of the house after the inside layer of plastic is in place.

Make provision for ventilation by having adjustable windows in the gable ends and openings in the side walls. Combination screen and plastic doors may also be used for ventilating.

Quonset-type greenhouse

A very sturdy yet inexpensive greenhouse can be built mostly of plywood (Fig. 14).

To make the rafters, lay a sheet of 10 mm (3/8 in.) plywood on the floor and with the use of a homemade compass (made from a nail in the floor as the center point, a wire tied to the nail for the radius, and a pencil at the other end of the wire) draw an arc along the longest part of the plywood sheet (Fig. 15). After you have drawn the first arc, move the center point 5.7 cm ($2^1/_4$ in.) away from the sheet and draw another arc parallel to the first. Use an electric saber saw or fine-toothed handsaw to cut carefully along the penciled marks on the plywood to make an arc 5 cm (2 in.) wide.

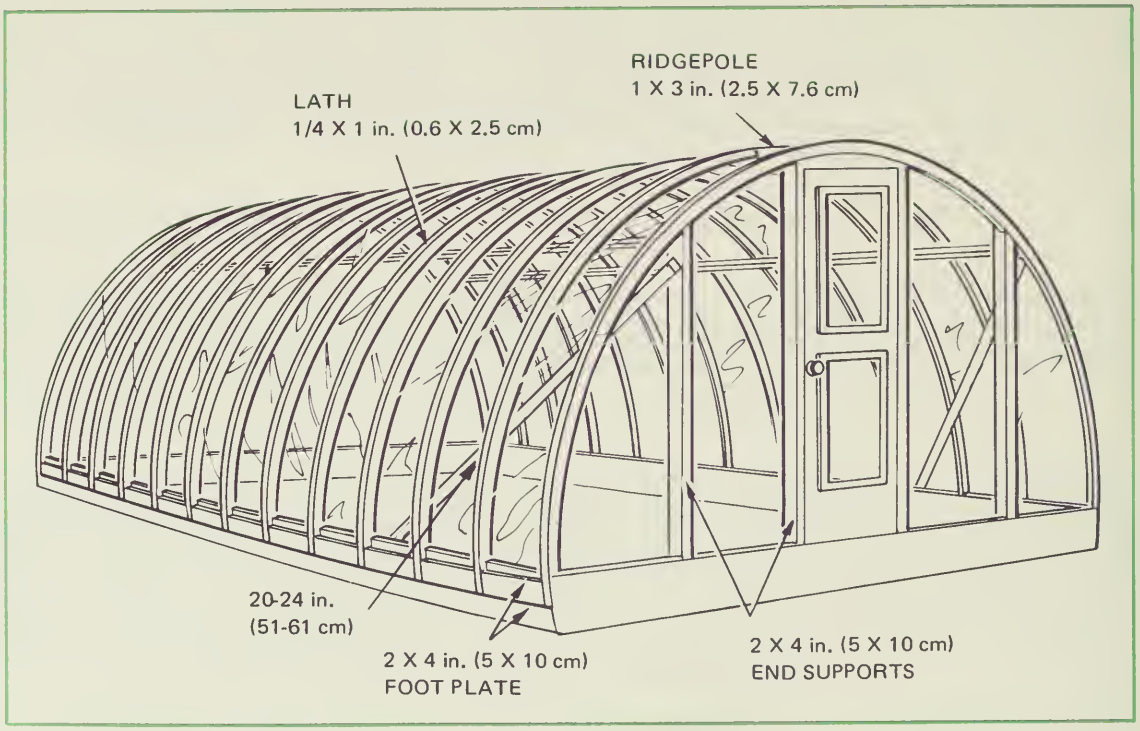


Fig. 14. A greenhouse with laminated plywood rafters.

Use the arc as a pattern and mark and cut the whole sheet of plywood into 5 cm (2 in.) strips. One sheet 1.2 X 2.4 m (4 X 8 ft) will make almost two rafters.

Arrange the arcs on the floor making sure that all joints are staggered to increase the strength of the arch. Glue and nail three strips together with waterproof glue

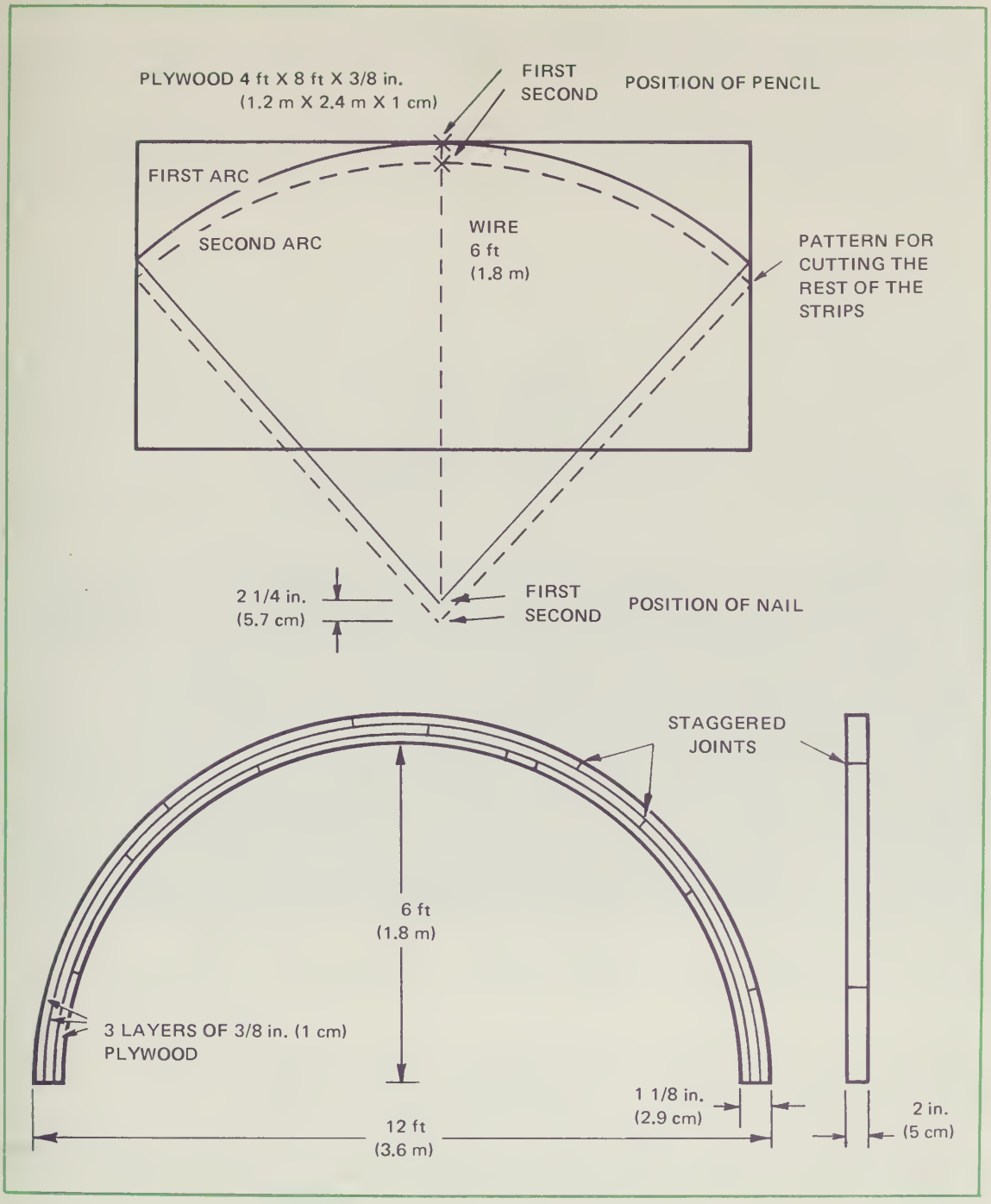


Fig. 15. How to mark the plywood for making laminated plywood rafters.

and 5 cm (2 in.) nails. Clinch the nails. Thoroughly sand the rafters to remove any sharp edges that might tear the plastic. Notch the ends of the rafters to fit over the foot plate and fasten them in with wood screws. Nail a ridgepole, with notches 2.5 cm (1 in.) deep for holding the rafters, into place under the center of the rafters to keep them properly spaced. It is important to have diagonal braces at the four corners of the greenhouse.

Frame the ends, leaving spaces for doors and ventilators. Doors with removable panels should be used for ventilation.

To fully insulate both types of houses it is best to use a double layer of plastic. For the outside layer use 0.1 mm (4 mil) or heavier polyethylene, or 0.25 mm (10 mil) cellulose-acetate-butyrate sheeting. First, tack the plastic in place on the rafters and then complete the fastening with 0.6 X 2.5 cm (1/4 X 1 in.) lath. Because the inside layer is not under stress from the wind, 0.05 mm (2 mil) plastic is adequate. The inside layer on flat walls can be fastened to the rafters with cardboard disks and tacks, but on the curved walls of a round house it must be carefully fastened with lath.

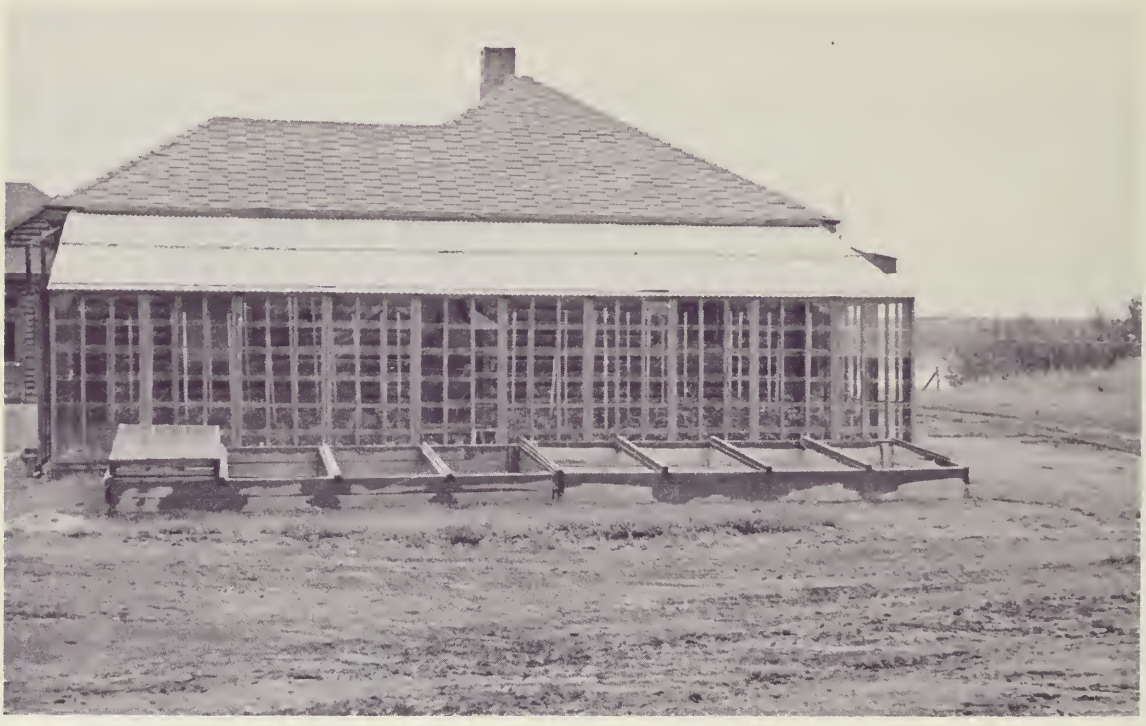


Fig. 16. Cold frames beside a lean-to greenhouse.

Greenhouses can be heated in various ways. A small greenhouse attached to a house or another heated building often needs little additional heat (Fig. 16). In small houses a 1500-watt electric heater may be satisfactory if the house is used only in the spring. In larger houses oil or gas heaters are the most economical. Usually heat is needed only in early spring and late fall. During late spring and summer, ventilating to keep the temperature down is often the biggest problem.

USING PLASTICS

In recent years several different types, grades, and gauges of plastic have been used for building shelters and hutches, making row-crop covers and mulches, and glazing greenhouses. Plastics are often preferable to glass, because they are cheaper and lighter and therefore do not require as heavy lumber in the frames.

For building hotbeds, cold frames, and small greenhouses clear polyethylene is a good average-grade material and a moderate price. The 0.15 mm (6 mil) material

comes in rolls 3 m (10 ft) wide and 30 m (100 ft) long, and the 0.1 mm (4 mil) gauge in widths of 0.9, 1.5, 2.1, and 3.0 m (36, 54, 84, and 120 in.) and 30 m (100 ft) long. The thinner grade is not as durable as the thicker grades.

For more permanent installations, and particularly if the plastic-covered panels or frames can be stored when not in use, a clear, 0.3 mm (12 mil) gauge material is well worth the extra cost.

If you use plastic in place of glass for hotbeds and cold frames, make the back of the frame at least twice as high as the front. This extra height is needed, because, unlike glass, plastic sags and needs more slope to allow the rain to run off.

Many plastics, particularly the thinner or cheaper grades, are not very durable and some of them may have to be replaced even before the end of one season. It is best, therefore, to use small squares, or narrow panels.

The plastics are light and can be placed on 5 X 5 cm (2 X 2 in.) lumber, but for easy handling do not build the panels larger than 1.2 X 2.4 m (4 X 8 ft). Place a supporting strip down the center to provide two 0.6 m (2 ft) panels.

To keep the plastic from flapping in the wind and tearing, hold it in place with laths or narrow plywood strips.

PROTECTION AGAINST FROST

To reduce the danger of frost, clear a path through the trees at the lowest part of the garden to allow the heavy, cold air to move down the garden and be replaced by warm air from the upper parts of the slope.

Plastic and glass shelters and loose plastic coverings over the plants will give some protection. A single layer of plastic will protect plants from very light frosts, whereas two layers spaced about 5 cm (2 in.) apart will give protection against about 2.8°C (5°F) of frost. Blankets and other cloth materials can also be used to cover plants overnight.

As little as 2.9 mm (1.2 in.) of water/hour applied through a fine sprinkler will protect potatoes and peas from air temperatures as low as −7.2°C (19°F). Often protection for one or two nights will prolong the growing season and double the yields (Fig. 17). Set up the sprinklers when there is a danger of frost, and turn them on when the air temperature reaches 0°C (32°F). Keep the sprinklers operating continuously until air temperatures return to above freezing.

Fig. 17. *Top*: A marigold coated with ice from sprinkler irrigation applied for protection against frost. *Bottom*: The uninjured marigold after the ice melted.

PART III

THE FRUIT AND ORNAMENTAL GARDEN

In many parts of the north a wide range of native fruits, perennials, small shrubs, and trees can be grown in the garden for fresh fruit and ornamental purposes. These

native plants vary widely in fruit quality and ornamental value, but by careful selection quite good specimens can be found growing wild and then transferred to your garden. The native plants often outperform introduced varieties.

If you intend to grow native plants, select the plants while they are in fruit or flower, mark them, and transplant them to your garden the next spring. Some perennials can be transplanted successfully while they are in flower, but others do better if moved in the early spring. However, many plants with deep roots do not transplant well and should be grown from seed. Collect the seed as soon as it is ripe, immediately plant it in a nursery or cold frame, and keep the soil damp until freeze-up. Usually some seed will germinate the following spring but the rest may not germinate for several years. As soon as the plants are large enough to handle, plant them in their permanent place in the garden. Most plants will flower the year after they germinate.

Many of the native fruits and ornamental trees and shrubs can also be grown from seed, but it takes several years before they are large enough to bear fruit or to be of ornamental value. It is best, therefore, to transplant small bushes or trees directly into the garden.

Early spring is the best time to transplant most trees, shrubs, and perennials. Evergreens may also be transplanted in summer if great care is taken to move them with a large ball of soil around their roots. See Canada Department of Agriculture Publication 1168, *Transplanting trees and shrubs,* for details of how to transplant.

The rules of good management for gardens in the north are the same as those for other regions, except for the following special methods. Other sources of information are given on page 38.

Fruits

Tree fruits In most parts of the north, apples, pears, plums, and cherries are not hardy enough or they are too late ripening. In the USSR, apple trees have been trained to stay close to the ground so that they are covered with snow during the winter. Good crops have been reported. If you are enthusiastic about growing apples, the method is worth trying. Be sure to protect the plants against mice and rabbits.

TABLE 3. RECOMMENDED BUSH FRUITS

Crop	Cultivar or variety
Currants, black	Climax, Magnus, Willoughby
red	Red Cross, Ruby Castle, Victoria
white	White Grape, White Imperial
Gooseberries	Abundance, Pixwell
Raspberries	Honeyking, Trent, Viking
Saskatoons	Pembina, Smoky
Strawberries	Pixie, Protem (plant new beds every 2 or 3 years)

Small fruits Gooseberries (*Ribes* spp.), red and black currants (*Ribes* spp.), cranberries and blueberries (*Vaccinium* spp.), raspberries (*Rubus* spp.), and rosehips (*Rosa* spp.) grow wild in many parts of the Yukon and the western parts of the Northwest Territories. Saskatoons (*Amelanchier alnifolia*) are also found in the southern parts of both territories. Cranberries and blueberries are best left growing in the wild, but with a little effort most of the other fruits can be moved to the garden.

Many cultivated varieties of bush fruits are fairly reliable for growing in northern regions (Table 3). Smoky and Pembina, varieties of saskatoon, are the hardiest and most reliable of the cultivated bush fruits. In most areas, cultivated raspberry canes should be bent to the ground in the late autumn and the tips anchored with soil so that the canes are covered with snow during the winter. The soil anchor must be removed as early as possible in spring to allow the canes to straighten up again.

Strawberries In many areas the hardy varieties of strawberries produce moderate crops, but in other areas they are difficult to grow. Protem is the hardiest variety available, but breeding programs are producing new hardy strawberries, some of which are half wild, that will be introduced soon. In areas where snow cover arrives before severe frost and stays all winter, there is no need to apply winter protection. However, if soil temperatures go below -9.4°C (15°F), coverings of straw, clean hay, or wood shavings should be added.

Ornamentals

It takes careful planning to arrange trees, shrubs, lawns, and flower beds in a pleasing manner. Divide the property surrounding your home into three areas: the approach area, which is the setting for the house when viewed from the street; the service area, which includes the driveway, garage, kitchen garden, and space for clothesline and garbage containers; and the recreation or garden area, which is a private area set aside for relaxation, lawn sports, and flower gardening. By carefully choosing trees and shrubs and by using walls and fences, you can separate these areas. *Planning your garden,* Canada Department of Agriculture Publication 1182, contains many useful landscaping principles for developing the home grounds and making them attractive.

Lawns Your lawn is a very important background to your home and landscaping. Kentucky bluegrass is the hardiest of the cultivated grasses but it is slow to germinate. Therefore, a mixture of 1 part by weight of Kentucky bluegrass and 4 parts creeping red fescue is recommended for most conditions.

Because drought is often a problem, your lawn will be greatly improved if it can be irrigated. During the winter do not pack the snow by driving, walking, or snowmobiling over your lawn. Packing the snow reduces the insulation value and increases the danger of winterkilling.

Trees and shrubs Most of the trees and shrubs that are common in gardens in the south are not suitable for the north. Also, the adaptability of each tree and shrub varies from area to area. At Mile 1019, Alaska Highway, the only imported trees and shrubs that are hardy enough are mugho pine (*Pinus mugo* var. *mughus*), Oriental spirea (*Spiraea media*), Altai rose (*Rosa spinosissima* var. *altaica*), hedge cotoneaster (*Cotoneaster lucida*), and golden clematis (*Clematis tangutica*). How-

ever, at Fort Simpson a much wider range of imported trees and shrubs can be grown (Table 4). Trees and shrubs that have been found hardy at Mile 1019 should be chosen first, and then those recommended for Fort Simpson.

TABLE 4. RECOMMENDED TREES AND SHRUBS

Common name	Scientific name	Notes
Trees		
Ash, green	*Fraxinus pennsylvanica* var. *lanceolata*	Hardy
Birch, white	*Betula papyrifera*	Native
Buckeye, Ohio	*Aesculus glabra*	Worthy of trial
Larch, Siberian	*Larix sibirica*	Very hardy and ornamental
Oak, bur	*Quercus macrocarpa*	Worthy of trial
Pine, Jack	*Pinus banksiana*	Native
lodgepole	*P. contorta* var. *latifolia*	Native
Scots	*P. sylvestris*	Worthy of trial
Poplar, northwest	*Populus* hybrid varieties	Broad spreading
Spruce, Colorado	*Picea pungens*	Worthy of trial
Norway	*P. abies*	Hardy
white	*P. glauca*	Native
Tamarack	*Larix laricina*	Native
Tall shrubs and small trees		
Bush-cranberry, high	*Viburnum trilobum*	Worthy of trial
Cherry, European bird	*Prunus padus*	Early, large white blossoms
Choke cherry, red	*Prunus virginiana*	Native
Schubert	*P. virginiana* var. *demissa*	Purple summer leaves
Elder, European red	*Sambucus racemosa*	Cutleaf variety
Hawthorn	*Crataegus douglasii*, *C. arnoldiana*	Worthy of trial
Honeysuckle, Tatarian	*Lonicera tatarica*, *L. tatarica* 'Beavermor'	Pink to white
Lilac, late	*Syringa villosa* hybrids	Small, mauve pink spikes
Preston	*S. prestoniae* 'Coral'	Coral pink
	'Donald Wyman'	Amaranth rose
	'Nocturne'	Hazy blue
	'Royalty'	Royal purple
Maple	*Acer tataricum*	
Mountain-ash, showy	*Sorbus decora*	Large, red fruit clusters
western	*S. scopulina*	Native
Peashrub, common caragana	*Caragana arborescens*	
pygmy	*C. pygmaea*	Bushy, low, orange, yellow blossoms
Sutherland	*C. arborescens* 'Sutherland'	Tall pyramidal growth, flowers but no seed
Saskatoon	*Amelanchier alnifolia*	Native, attractive flowers and fruit
Silverberry	*Elaeagnus commutata*	Native, silver foliage
Low shrubs		
Almond, Russian	*Prunus tenella*	Pink blossoms, early June
Buffaloberry	*Shepherdia* spp.	Native, red berries
Bush-cranberry, low	*Viburnum edule*	Bright red leaves in fall
Cedar, eastern white	*Thuja occidentalis*	Evergreen, protect from direct winter sun by planting behind deciduous trees

TABLE 4. RECOMMENDED TREES AND SHRUBS (*Concluded*)

Common name	Scientific name	Notes
Cherry, Manchu	*Prunus tomentosa*	Pink blossoms, early June
Cinquefoil, Farrer bush	*Potentilla fruticosa* var. *farrerii*	Spreading
Friedrichsen bush	*P. fruticosa* var. *friedrichsenii*	Lemon yellow, June-Sept.
Jackman's bush	*P. fruticosa* var. *jackmannii*	
shrubby	*P. fruticosa*	Native, yellow blossoms June-Sept.
Cotoneaster, European	*Cotoneaster integerrima*	Spreading red berries
Peking	*C. acutifolia*	Glossy leaves, black berries
Currant, golden	*Ribes aureum*	Fragrant blossoms, sun or shade
Hudson Bay	*R. hudsonianum*	Black fruit
Dogwood, red osier	*Cornus stolonifera*	Native, cream fruit, red and white bark, sun or shade
Honeysuckle, Albert Thorn	*Lonicera spinosa* var. *albertii*	Prostrate, mauve blossoms
climbing	*L. hirsuta* hybrid 'Dropmore Scarlet Trumpet'	Red flower clusters in July
Juniper, common	*Juniperus communis*	Native
creeping	*J. horizontalis*	Native
Dunvegan blue	*J. horizontalis*	Native selection
Wapiti	*J. horizontalis*	Native selection
Rose, bush	*Rosa* 'Altai Scotch'	Cream white, single
	'Betty Bland'	Pink, double, red bark
	'Blanc Double de Coubert'	
	'Hansa'	Red, double, all summer
	'Lac-la-Nonne'	Dark pink, semidouble
	'Mrs. Anthony Waterer'	
	'Mrs. John McNab'	White double
	'Parfum de la Haye'	
	'Tetonkaha'	Dark pink, semidouble
	'Therese Bugnet'	Pink, double, all summer, red winter bark
	'Wasagaming'	
	'Yatkan'	Dark pink, semidouble
prickly	*Rosa acicularis*	Very attractive fruit, native
Spirea	*Spiraea flexuosa*	Bright green leaves, large blooms
	S. gilliardi	
	S. macrothyrsa	Bright pink, dense panicles
false	*Sorbaria sorbifolia*	Creamy plumes all summer
Korean	*Spiraea trichocarpa*	Late bloom
Oriental	*S. media*	Profuse white bloom
	S. media 'Sericea'	Silky pubescent leaves
	S. petrovoskia	
Polish	*S. pikoviensis*	Taller than Oriental
Rosabella	*S. betulifolia* hybrid 'Rosabella'	Pale pink all summer
Three-lobed	*S. trilobata*	Very profuse white bloom
Vanhoutte, bridalwreath	*S. vanhouttei*	Profuse white bloom
Willow, Bebb	*Salix bebbiana*	Native, elliptical leaves
peachleaf	*S. amygdaloides*	Native, long narrow leaves
silver	*Salix* spp.	Native, attractive foliage

Wherever possible, native trees and shrubs should be used as the foundation of any landscape plan. The native pines (*Pinus contorta* var. *latifolia* and *P. banksiana*), white spruce (*Picea glauca*), tamarack (*Larix laricina*), white birch (*Betula papyrifera*), and poplar (*Populus* spp.) are much more attractive than imported trees disfigured by winter injury. Similarly, native willows (*Salix* spp.), saskatoon (*Amelanchier alnifolia*), red osier dogwood (*Cornus stolonifera*), shrubby cinquefoil (*Potentilla fruticosa*), buffaloberries (*Sheperdia* spp.), and many others make attractive ornamentals.

Good growth and the establishment of attractive long-living trees take some effort, they rarely just happen. Methods for growing and pruning ornamental trees and

TABLE 5. RECOMMENDED PERENNIAL FLOWERS

Common name	Scientific name	Height cm	Height (in.)	Season	Color
Anemone	*Anemone* spp.	5-76	(2-30)	June	Mixed
Baby's-breath	*Gypsophila paniculata*	76-91	(30-36)	July	White
Baby's-breath, creeping	*G. repens*	25-30	(10-12)	July	Pink
Beardtongue	*Penstemon* spp.	30-60	(12-24)	June	Pink
Bleedingheart, plume	*Dicentra eximia*	46-76	(18-30)	June	Pink
Bluebells of Scotland	*Campanula rotundifolia*	30	(12)	July	Blue
Brown-eyed Susan	*Rudbeckia triloba*	122	(48)	July	Yellow
Campion, Hauge	*Lychnis haageana*	30	(12)	July	Scarlet
Candytuft, perennial	*Iberis sempervirens*	10-20	(4-8)	June	White
Catchfly, German	*Lychnis viscaria*	30	(12)	July	Rose purple
Columbine, long-spurred	*Aquilegia* spp.	46-76	(18-30)	June	Mixed
Day-lily	*Hemerocallis* spp.	60-76	(24-30)	Aug.	Yellow
Delphinium	*Delphinium elatum*	30-240	(12-96)	June	Mixed
Flax, golden	*Linum flavum* var. *compactum*	25	(10)	June	Gold
Forget-me-not	*Myosotis alpestris*	20-30	(8-12)	July	Blue
Fritillaria	*Fritillaria* spp.	25	(10)	June	Yellow and cream
Gaillardia	*Gaillardia aristata*	46	(18)	July	Orange
Globeflower	*Trollius albiflorus*	30	(12)	June	White
Goldenrod	*Solidago* spp.	60-91	(24-36)	July	Yellow
Houseleek	*Sempervivum montanum*	25	(10)	July	Foliage
Iris, Siberian	*Iris sibirica*	60-91	(24-36)	July	Blue and white
Lily	*Lilium elegans* 'Thunberg' and 'Lyla McCann'	30-60	(12-24)	July	Red Orange
Loosestrife, purple	*Lythrum salicaria* var. *roseum*	60-91	(24-36)	July	Purple
Lupine, native	*Lupinus* spp.	46-76	(18-30)	June	Blue
Maltese cross	*Lychnis chalcedonica*	60-91	(24-36)	July	Scarlet
Marguerite, golden	*Anthemis tinctoria*	20-30	(8-12)	July	Gold
Onion and chives (wild and perennial)	*Allium* spp.	15-60	(6-24)	July	White
Pansy	*Viola* spp.	13-23	(5-9)	June	Mixed
Peony	*Paeonia* 'Reine Hortense', 'Edulis Superba', 'Felix Crouse', 'Sarah Bernhardt', 'Marie Lemoine', 'Mons Jules', 'Festiva Maxima', 'Karl Rosenfield'	46-76	(18-30)	June	Mixed

TABLE 5. RECOMMENDED PERENNIAL FLOWERS (*Concluded*)

Common name	Scientific name	Height cm	Height (in.)	Season	Color
Perennial flax	*Linum perenne*	25-38	(10-15)	June	Blue
Phlox, summer perennial	*Phlox paniculata*	46-76	(18-30)	July	Mauve
Pink, grass, or cottage	*Dianthus plumarius*	30-60	(12-24)	June	Mixed
Pink, maiden	*D. deltoides*	10-15	(4-6)	June	Rose
Poppy, Iceland	*Papaver nudicaule*	20-40	(8-16)	June	Mixed
Poppy, Oriental	*P. orientale*	60-91	(24-36)	June	Scarlet
Pussytoes	*Antennaria* spp.	2-50	(1-20)	July Aug.	White and pink
Pyrethrum, painted daisy	*Chrysanthemum coccineum*	60-91	(24-36)	June	Mixed
Ribbon grass	*Phalaris arundinacea* var. *picta*	75	(30)	July	Foliage
Rock-cress, mountain	*Arabis alpina*	10-20	(4-8)	June	White
Soapwort, rock	*Saponaria ocymoides*	15	(6)	June	Pink
Speedwell	*Veronica spicata*	60-91	(24-36)	Aug.	Blue
Stonecrop	*Sedum* spp.	5-20	(2-8)	July Aug.	Purple to cream
Tulip	*Tulipa tarda, T. urumiensis, T. turkistanica, T. pulchella* var. *humilis, T. praestans,* selected Darwins, and lily-flowered	10-46	(4-18)	June	Mixed
Yarrow	*Achillea millefolium*	30-60	(12-24)	July	White

shrubs can be found in Canada Department of Agriculture publications 994 and 1505 (see list of publications on page 38).

Herbaceous perennials Only a few perennial flower cultivars will grow in some areas, whereas the selection is much more extensive in others (Table 5). However, in all areas a large selection of native perennials can be grown. The native columbines (*Aquilegia* spp.), lilies (*Lilium* spp.), perennial flax (*Linum perenne*), lupines (*Lupinus* spp.), and perennial asters (*Chrysanthemum* spp.) are close relatives of the cultivated forms.

Annuals Annual flowers are very useful in improving the appearance of the property surrounding your home, and many of them can be used for cut flowers. A list of tried and tested annuals is given in Table 6, but experienced gardeners should try a few new varieties each year. Flower transplants should be grown in the same way as vegetable transplants.

TABLE 6. RECOMMENDED ANNUAL FLOWERS

Common name	Scientific name	Use
Can be grown from seed sown in the garden		
Baby blue-eyes	*Nemophila menziesii*	Border
Baby's-breath	*Gypsophila elegans*	Background
Canary birdflower	*Tropaeolum peregrinum*	Bedding
Candytuft, rocket	*Iberis amara*	Border
Clarkia	*Clarkia pulchella*	Bedding
Cornflower or batchelor's-button	*Centaurea cyanus*	Bedding
Flax, scarlet	*Linum* spp.	Bedding
Godetia	*Godetia grandiflora*	Bedding
Mignonette, common	*Reseda odorata*	Bedding
Poppy, California	*Eschscholtzia californica*	Bedding
Summer-cypress	*Kochia scoparia* var. *culta*	Background
Sunflower	*Helianthus* spp.	Background
Ten-weeks stock	*Matthiola incana* var. *annua*	Bedding
Can be grown from seed sown in the garden, but they bloom better and longer if started inside and transplanted after danger of frost has passed		
Butterflyflower	*Schizanthus* spp.	Bedding
Cosmos	*Cosmos bipinnatus*	Background
Daisy, South African	*Dimorphotheca aurantiaca*	Border
Marigold, pot	*Calendula officinalis*	Bedding
Nasturtium, garden	*Tropaeolum majus*	Bedding
Nemesia	*Nemesia* spp.	Border
Strawflower	*Helichrysum* spp.	Background
Sweet pea	*Lathyrus odoratus*	Background
Zinnia	*Zinnia elegans*	Bedding
Should be started inside and transplanted to the garden after danger of frost is past		
Alyssum, sweet	*Lobularia procumbens*	Border
Aster, China	*Callistephus chinensis*	Border and bedding
Coreopsis or tickseed	*Coreopsis* spp.	Background
Daisy, Swan River	*Brachycome iberidifolia*	Border
Dahlia	*Dahlia* spp.	Bedding
Lobelia	*Lobelia erinus*	Border
Love-in-a-mist	*Nigella damascena*	Bedding
Marigold, African	*Tagetes erecta*	Border and bedding
Marigold, French	*T. patula*	Border and bedding
Marigold, Mexican	*T. tenuifolia* var. *pumila*	Bedding
Paintedtongue	*Salpiglossis sinuata*	Background
Pansy	*Viola tricolor*	Bedding
Petunia	*Petunia hybrida*	Bedding
Poppy, corn	*Papaver rhoeas*	Background
Rose-moss or portulaca	*Portulaca grandiflora*	Bedding or border
Sage, scarlet	*Salvia splendens*	Bedding
Snapdragon	*Antirrhinum majus*	Bedding

STORAGE OF FRUITS AND VEGETABLES

The value and pleasure of your garden can be carried over into the winter months by storing the fruit and vegetables you have grown.

All fruits and highly perishable vegetables such as peas, broad beans, spinach, broccoli, cauliflower, and Brussels sprouts must be frozen or processed. Many useful hints are given in Canada Department of Agriculture publications 892, *Freezing foods;* 992, *Jams, jellies, and pickles;* and 1560, *Canning Canadian fruits and vegetables.*

When stored properly, vegetables such as potatoes, carrots, rutabagas, beets, cabbage, parsnips, and onions can be stored without freezing or preserving. Temperature and humidity are very important in the storage of vegetables and they vary with different types of vegetables. Potatoes must be stored at 3.3–4.4°C (38–40°F) and high humidity, whereas onions require cool, dry storage conditions.

Details on how to build a storeroom for fruit and vegetables and hints on the storage conditions needed for each crop are contained in Canada Department of Agriculture Publication 1478, *Home storage room for fruits and vegetables.*

OTHER HELPFUL PUBLICATIONS

The following publications may be obtained on request from: Information Division, Agriculture Canada, Ottawa, Ontario K1A 0C7

796 Annual flowers for Canadian gardens. 1973
868 Manures and compost. Revised 1974
869 Lime and other soil amendments. 1961
892 Freezing foods. Revised 1974
970 Growing herbaceous perennials. 1956
992 Jams, jellies, and pickles. 1956
994 Culture of ornamental trees for Canadian gardens. 1957
1033 Growing vegetables in the Prairie garden. Revised 1969
1059 Home vegetable growing. 1959
1163 Lawns. Revised 1975
1168 Transplanting trees and shrubs. 1963
1182 Planning your garden. 1963 (obtainable from Information Canada for $1.25)
1337 How to build a plastic crop shelter or greenhouse. 1967
1369 Rhubarb planting and growing. 1968
1408 Gardening on permafrost. 1970
1466 Farming potential of the Canadian northwest. 1972
1478 Home storage room for fruits and vegetables. Revised 1974
1505 Pruning manual for ornamental trees and shrubs. 1973

Research Station, Agriculture Canada, Box 29, Beaverlodge, Alberta T0H 0C0
Strawberry growing in the Peace River region. 1970.

British Columbia Department of Agriculture, Victoria, British Columbia V8W 2Z7
71-2 Small greenhouse construction and management. 1971.

Your library should be able to obtain copies of the following scientific papers for you:

Gubbels, G. H. 1969. Frost protection of crops by sprinkler. Can. J. Plant Sci. 49:715-718.

Gubbels, G. H. 1971. Response of cabbage grown north of latitude 60°N to plastic mulch, ridging, and row orientation. Can. J. Plant Sci. 51:17-20.

Gubbels, G. H. 1972. Yield increases from frost control on potato and garden pea. Can. J. Plant Sci. 52:250-251.

Gubbels, G. H. 1972. Effects of plastic mulch and row spacing on carrot growth north of latitude 60°N. Can. J. Plant Sci. 52:660-661.

Harris, R. E. 1965. Polyethylene covers and mulches for corn and bean production in northern regions. J. Proc. Am. Soc. Hortic. Sci. 69:400-404.

CONVERSION FACTORS FOR METRIC SYSTEM

Imperial units	Approximate conversion factor	Results in:	
LINEAR			
inch	x 25	millimetre	(mm)
foot	x 30	centimetre	(cm)
yard	x 0.9	metre	(m)
mile	x 1.6	kilometre	(km)
AREA			
square inch	x 6.5	square centimetre	(cm^2)
square foot	x 0.09	square metre	(m^2)
acre	x 0.40	hectare	(ha)
VOLUME			
cubic inch	x 16	cubic centimetre	(cm^3)
cubic foot	x 28	cubic decimetre	(dm^3)
cubic yard	x 0.8	cubic metre	(m^3)
fluid ounce	x 28	millilitre	(mL)
pint	x 0.57	litre	(L)
quart	x 1.1	litre	(L)
gallon	x 4.5	litre	(L)
WEIGHT			
ounce	x 28	gram	(g)
pound	x 0.45	kilogram	(kg)
short ton (2000 lb)	x 0.9	tonne	(t)
TEMPERATURE			
degrees Fahrenheit	(°F-32) x 0.56 or (°F-32) x 5/9	degrees Celsius	(°C)
PRESSURE			
pounds per square inch	x 6.9	kilopascal	(kPa)
POWER			
horsepower	x 746	watt	(W)
	x 0.75	kilowatt	(kW)
SPEED			
feet per second	x 0.30	metres per second	(m/s)
miles per hour	x 1.6	kilometres per hour	(km/h)
AGRICULTURE			
gallons per acre	x 11.23	litres per hectare	(L/ha)
quarts per acre	x 2.8	litres per hectare	(L/ha)
pints per acre	x 1.4	litres per hectare	(L/ha)
fluid ounces per acre	x 70	millilitres per hectare	(mL/ha)
tons per acre	x 2.24	tonnes per hectare	(t/ha)
pounds per acre	x 1.12	kilograms per hectare	(kg/ha)
ounces per acre	x 70	grams per hectare	(g/ha)
plants per acre	x 2.47	plants per hectare	(plants/ha)